PLASMA REACTOR WITH OVERHEAD RF ELECTRODE TUNED TO THE PLASMA WITH ARCING SUPPRESSION

ABSTRACT OF THE DISCLOSURE

A plasma reactor for processing a semiconductor workpiece, includes a reactor chamber having a chamber wall and containing a workpiece support for holding the semiconductor workpiece, an overhead electrode overlying said workpiece support, the electrode comprising a portion of said chamber wall, an RF power generator for supplying power at a frequency of said generator to said overhead electrode and capable of maintaining a plasma within said chamber at a desired plasma ion density level. The overhead electrode has a capacitance such that said overhead electrode and the plasma formed in said chamber at said desired plasma ion density resonate together at an electrode-plasma resonant frequency, said frequency of said generator being at least near said electrode-plasma resonant frequency. The reactor further includes an insulating layer formed on a surface of said overhead electrode facing said workpiece support, a capacitive insulating layer between said RF power generator and said overhead electrode, and a metal foam layer overlying and contacting a surface of said overhead electrode that faces away from said workpiece support.